

What is claimed is:

1. A system for determining a DTMF tone from an input signal, said system comprising:

5 a trained data base for storing a plurality of reference templates, at least some of said reference templates representative of likelihood ratios;

a likelihood ratio determination module coupled to said trained data base, said likelihood ratio determination module receiving a plurality of LPC coefficients, said LPC coefficients being representative of an input signal, said likelihood ratio determination
10 module determining a plurality of current likelihood ratios based, at least in part, upon said LPC coefficients;

a pattern matching module coupled to said trained data base and said likelihood ratio determination module, said pattern matching module determining an initial tone based, at least in part, on the minimum of said current likelihood ratios and the minimum
15 of said reference likelihood ratios; and

a tone acceptance module coupled to said pattern matching module, said tone acceptance module receiving a plurality of LSF coefficients, said LSF coefficients determined, at least in part, upon said input signal, said tone acceptance module verifying the validity of said initial tone based, at least in part, upon said LSF
20 coefficients.

2. The system of claim 1 wherein said pattern matching module also compares said minimum current ratio to a predetermined threshold.

3. The system of claim 1 wherein there are exactly 16 LPC coefficients.
4. The system of claim 1 wherein there are exactly 16 LSF coefficients.
5. A method for determining a DTMF tone, said method comprising:
storing a plurality of reference templates, at least some of said reference templates representative of likelihood ratios;
receiving a plurality of LPC coefficients, said LPC coefficients being representative of an input signal;
determining a plurality of current likelihood ratios based, at least in part, upon said LPC coefficients;
determining an initial tone based, at least in part, on the minimum of said current likelihood ratios and the minimum of said reference likelihood ratios;
receiving a plurality of LSF coefficients, said LSF coefficients determined, at least in part, upon said input signal; and
verifying the validity of said initial tone based, at least in part, upon said LSF coefficients.
6. The method of claim 5 comprising the further step of determining said LPC coefficients.
7. The method of claim 5 comprising the further step of determining said LSF coefficients.

8. The method of claim 5 comprising the further step of transmitting said tone to an outside entity.

9. A system for determining a DTMF tone, said system comprising:

5 means for storing a plurality of reference templates, at least some of said reference templates representative of likelihood ratios;

means for receiving a plurality of LPC coefficients, said LPC coefficients being representative of an input signal;

10 means for determining a plurality of current likelihood ratios based, at least in part, upon said LPC coefficients;

means for determining an initial tone based, at least in part, on the minimum of said current likelihood ratios and the minimum of said reference likelihood ratios;

means for receiving a plurality of LSF coefficients, said LSF coefficients determined, at least in part, upon said input signal; and

15 means for verifying the validity of said initial tone based, at least in part, upon said LSF coefficients.

10. A computer program for determining a DTMF tone, said computer program comprising:

20 first code for storing a plurality of reference templates, at least some of said reference templates representative of likelihood ratios;

second code for receiving a plurality of LPC coefficients, said LPC coefficients being representative of an input signal;

third code for determining a plurality of current likelihood ratios based, at least in part, upon said LPC coefficients;

fourth code for determining an initial tone based, at least in part, on the minimum of said current likelihood ratios and the minimum of said reference likelihood ratios;

5 fifth code for receiving a plurality of LSF coefficients, said LSF coefficients determined, at least in part, upon said input signal; and

sixth code for verifying the validity of said initial tone based, at least in part, upon said LSF coefficients.

10 11. A computer readable medium having stored therein instructions for causing a processing unit to execute the following method:

storing a plurality of reference templates, at least some of said reference templates representative of likelihood ratios;

receiving a plurality of LPC coefficients, said LPC coefficients being representative of
15 an input signal;

determining a plurality of current likelihood ratios based, at least in part, upon said LPC coefficients;

determining an initial tone based, at least in part, on the minimum of said current likelihood ratios and the minimum of said reference likelihood ratios;

20 receiving a plurality of LSF coefficients, said LSF coefficients determined, at least in part, upon said input signal; and

verifying the validity of said initial tone based, at least in part, upon said LSF coefficients.

12. A method for determining a DTMF tone comprising:
- receiving an input signal;
- determining the auto-correlates of said input signal;
- determining a plurality of LPC coefficients from said plurality of auto-correlates;
- 5 determining a plurality of LSF coefficients from said plurality of said LPC coefficients;
- determining a plurality of current likelihood ratios using said auto-correlates and said LPC coefficients;
- determining a plurality of reference likelihood ratios;
- 10 determining an initial tone at least in part by using the minimum of said plurality of said current likelihood ratios and said minimum of said plurality of reference likelihood ratios; and
- confirming the validity of said initial tone at least in part by using said LSF coefficients.
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13. The method of claim 12 wherein said step of determining LPC coefficients determines exactly 16 LPC coefficients.
14. The method of claim 12 wherein said step of determining LSF
- 20 coefficients determines exactly 16 LSF coefficients.

15. A system for determining a DTMF tone, said system comprising:
- means for receiving an input signal;
- means for determining the auto-correlates of said input signal;

means for determining a plurality of LPC coefficients from said plurality of auto-correlates;

means for determining a plurality of LSF coefficients from said plurality of said LPC coefficients;

5 means for determining a plurality of current likelihood ratios using said auto-correlates and said LPC coefficients;

means for determining a plurality of reference likelihood ratios;

means for determining an initial tone at least in part by using the minimum of said plurality of said current likelihood ratios and said minimum of said plurality of reference

10 likelihood ratios; and

means for confirming the validity of said initial tone at least in part by using said LSF coefficients.

16. A computer program for determining a DTMF tone, said computer
15 program comprising:

first code for receiving an input signal;

second code for determining the auto-correlates of said input signal;

third code for determining a plurality of LPC coefficients from said plurality of auto-correlates;

20 fourth code for determining a plurality of LSF coefficients from said plurality of said LPC coefficients;

fifth code for determining a plurality of current likelihood ratios using said auto-correlates and said LPC coefficients;

sixth code for determining a plurality of reference likelihood ratios;

seventh code for determining an initial tone at least in part by using the minimum of said plurality of said current likelihood ratios and said minimum of said plurality of reference likelihood ratios; and
eighth code for confirming the validity of said initial tone at least in part by using said
5 LSF coefficients.

17. A computer readable medium having stored therein instructions for causing a processing unit to execute the following method:

receiving an input signal;
10 determining the auto-correlates of said input signal;
determining a plurality of LPC coefficients from said plurality of auto-correlates;
determining a plurality of LSF coefficients from said plurality of said LPC coefficients;
determining a plurality of current likelihood ratios using said auto-correlates and
15 said LPC coefficients;
determining a plurality of reference likelihood ratios;
determining an initial tone at least in part by using the minimum of said plurality of said current likelihood ratios and said minimum of said plurality of reference likelihood ratios; and
20 confirming the validity of said initial tone at least in part by using said LSF coefficients.

18. A system for determining a DTMF tone, said system comprising:

an auto-correlation module, said auto correlation determining a plurality of auto-correlates for an input signal;

a LPC analysis module coupled to said auto-correlation module, said LPC analysis module determining a plurality of LPC coefficients from said plurality of auto-correlates;

5 a likelihood ratio determination module for determining a plurality of current likelihood ratios of said LPC coefficients;

a data base coupled to said auto-correlation module and said likelihood ratio determination module, for storing a plurality of reference likelihood ratios;

10 a pattern matching module for determining an initial tone at least in part by determining the minimum of said plurality of current likelihood ratios and said minimum of said plurality of reference likelihood ratios;

a LSF analysis module coupled to said LPC analysis module for determining a plurality of LSF coefficients from said plurality of LPC coefficients; and

15 a tone acceptance module coupled to said LSF analysis module and said pattern-matching module for verifying the validity of said initial tone using said LSF coefficients.